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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. 017.38841X00

First Inventor or Application Identifier Stefano FACCIN

Title See 1 in Addendum

Express Mail Label No.

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages 18]
(preferred arrangement set forth below)
 - Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 1]
4. Oath or Declaration [Total Pages]
 - a. ☐ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

* NOTE FOR ITEMS 1 & 13 IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

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5. ☐ Microfiche Computer Program (Appendix)
6. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
 - a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☐ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement of Power of Attorney (when there is an assignee)
9. ☐ English Translation Document (if applicable)
10. ☒ Information Disclosure Statement (IDS)/PTO-1449 ☒ Copies of IDS Citations
11. ☐ Preliminary Amendment
12. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. ☐ * Small Entity Statement(s) ☐ Statement filed in prior application
(PTO/SB/09-12) Status still proper and desired
14. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
15. ☒ Other: Credit Card Payment Form
Unexecuted Declaration

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. /

Prior application information: Examiner

Group / Art Unit:

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

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Henry Zykorie

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27,477

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**Attachment to PTO/SB/05 (4/98) Utility Patent Application
Transmittal**

1. **TECHNIQUES FOR PERFORMING UMTS (UNIVERSAL MOBILE
TELECOMMUNICATIONS SYSTEM) AUTHENTICATION USING SIP (SESSION
INITIATION PROTOCOL) MESSAGES**

TECHNIQUES FOR PERFORMING UMTS (UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM) AUTHENTICATION USING SIP (SESSION INITIATION PROTOCOL) MESSAGES

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to techniques for performing authentication using SIP (Session Initiation Protocol) messages. More particularly, the present invention relates to techniques for performing UMTS (Universal Mobile Telecommunications System) authentication using SIP messages.

Description of the Related Art

The SIP has been selected as the protocol over the UNI (User to Network Interface), that is, the interface between the mobile subscriber and the CSCF (Call State Control Function), for R00 (release 2000) and the current UMTS AKA (Authentication and Key Agreement) is one proposal for the authentication mechanism for the R00 UMTS.

The SIP has been defined in the IETF (Internet Engineering Task Force) draft standard RFC2543 (Request For Comments), issued March 1999 and the UMTS AKA has been defined in the 3GPP (3d Generation Partnership Project) specification TS 33.102, version 3.5.0, Release 1999, issued July 2000. The contents of this draft standard in

its entirety and the contents of this specification in its entirety are both incorporated by reference herein.

As stated in the draft standard:

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol for creating, modifying and terminating sessions with one or more participants. The sessions include Internet multimedia conferences, Internet telephone calls and multimedia distribution. Members in a session can communicate via multicast or via a mesh of unicast relations, or a combination of these.

SIP invitations used to create sessions carry session descriptions which allow participants to agree on a set of compatible media types. SIP supports user mobility by proxying and redirecting requests to the user's current location. Users can register that current location. SIP is not tied to any particular conference control protocol. SIP is not designed to be independent of the lower-layer transport protocol and can be extended with additional capabilities.

However, the use of the UMTS AKA procedure to perform authentication through SIP messages has not been disclosed in the draft standard.

Furthermore, in the IP Multimedia (IM) subsystem, which supports mobile IP telephony, a subscriber authentication mechanism must be standardized. Such an authentication mechanism has not yet been standardized. However, the UMTS AKA procedure will most likely be the chosen authentication mechanism. Therefore, a technique to perform UMTS AKA using the SIP protocol must be defined.

SUMMARY OF THE INVENTION

An object of the present invention, therefore, is to provide techniques for performing authentication using the UMTS AKA procedure and carrying the corresponding UMTS parameters through SIP messages. The authentication may be performed either by creating a new UMTS AKA authentication mode with the appropriate fields contained within an SIP message or alternatively, the authentication may be performed by reusing and adapting an existing authentication mode (e.g.-the digest mode or the PGP mode) of an SIP message.

Another object of the present invention, in the case of an IM subsystem, is to use SIP messages, which have been selected to be used as the call control protocol between the UE (User Equipment) and the CSCF, to carry the authentication parameters.

Still another object of the present invention is to reuse the UMTS AKA mechanism as a possible solution for the authentication procedure in the IM subsystem.

A further object of the present invention is to define which SIP messages and header fields are to be used to carry the UMTS authentication parameters in order to use the UMTS AKA mechanism for subscriber authentication in the IM subsystem and how to include the UMTS authentication parameters in the SIP header fields.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and a better understanding of the present invention will become apparent from the following detailed description of example embodiments and the claims when read in connection with the accompanying drawings, all forming a part of the disclosure of this invention. While the foregoing and following written and illustrated disclosure focuses on disclosing example embodiments of the invention, it should be clearly understood that the same is by way of illustration and example only and the invention is not limited thereto. The spirit and scope of the present invention are limited only by the terms of the appended claims.

The following represents brief descriptions of the drawings, wherein:

Figure 1 illustrates an example of data flow between an SIP UA (User Agent) and a CSCF.

Figure 2 illustrates an example of data flow between an SIP UA and a CSCF.

DETAILED DESCRIPTION

Before beginning a detailed description of the subject invention, mention of the following is in order. When appropriate, like reference numerals and characters may be used to designate identical, corresponding, or similar components in differing drawing figures. Furthermore, in the detailed description to follow, example sizes/models/values/ranges may be given, although the present invention is not limited thereto. In addition, elements may not be shown within the drawing figures for simplicity of illustration and discussion and so as not to obscure the invention.

Figure 1 illustrates an example of data flow between an SIP UA and a CSCF . However, a Proxy server may be substituted for the CSCF. According to the security policies, when a UMTS AKA needs to be performed, (e.g.-at a call setup or at registration), UA in the UE sends a REGISTER or INVITE request to the CSCF or Proxy. The CSCF or proxy can accept the registration with the 200 OK message or ask for an authorization with the 401 Unauthorized response.

According to the aforecited 3GPP specification, in order to execute a UMTS AKA procedure, to parameters must be sent to the user to authenticate it, namely, the RAND and the AUTN, and then the user will respond.

Therefore, 401 response includes the WWW-Authenticate response header field which contains the required authorization scheme and related parameters. In performing the UMTS AKA procedure in accordance with a present invention, the WWW-Authenticate header includes the RAND (RANDOM challenge) and AUTN (Authentication Token).

After a 401 response, the UA may send a new REGISTER or INVITE request, which should contain the appropriate authorization information in the Authorization header field. In the case of the UMTS AKA procedure in accordance with the present invention, the Authorization header contains the RES or the AUTS or an error code (for example, an error message can be sent if the MAC (Message Authentication Code) is considered to be invalid).

Referring now to Figure 2, which illustrates proxy authentication after an INVITE request is presented, upon the UA forwarding an INVITE request to the CSCF, the CSCF may ask for an authentication with a 407 Proxy Authentication Required response. The 407 responds contains a Proxy-Authenticate response header field which contains the required authorization scheme and related parameters.

After receiving the 407 response, the UA sends an ACK (acknowledgment) response and may repeat the INVITE request, the repeated request containing the appropriate

authentication information in the Proxy-Authorization header field.

In the case of the UMTS AKA procedure, the Proxy-Authenticate header contains the same information as the WWW-Authenticate header and the Proxy-Authorization header contains the same information as the Authorization header. Since this procedure can be used only when the UA sends a request, for example, when it initiates a call, the procedure cannot substitute for the authentication at registration.

Note that the REGISTER request, 200 OK message, and 401 Unauthorized response, as well as other parameters and elements contained in the above-noted discussion, are all clearly defined in the aforementioned RFC2543 draft standard.

The aforementioned draft standard defines three different techniques for SIP authentication, namely, an HTTP "basic" authentication mechanism and an HTTP "digest" authentication mechanism, and a PGP (Pretty Good Privacy) authentication mechanism. The HTTP authentication mechanisms are defined in the IETF draft standard RFC2617, issued June, 1999. The contents of this draft standard in its entirety are incorporated by reference herein.

While the three different techniques for SIP authentication are usable, for simplicity, the UMTS AKA technique may be advantageously used instead and the UMTS AKA elements may be substituted for the elements used for

the three other SIP authentication techniques without needing a format revision in the SIP standard.

Accordingly, in accordance with the present invention, a 401 response includes a WWW-Authenticate response header field which contains the UMTS AKA authentication vectors, that is, the RAND (RANDOM challenge) and the AUTN (authentication token).

After a 401 response, the UE sends a new REGISTER/INVITE request which should contain the appropriate authentication information in the Authorization header field: the authentication response (RES), a synchronization failure parameter (AUTS), or an error code can be sent if the MAC (Message Authentication Code) is considered to be invalid.

Note that for a call setup, as will be discussed below, a 407 Proxy Authentication Required response may alternatively be used to carry the UMTS AKA parameters.

The present invention defines two ways to carry the UMTS AKA parameters in the SIP messages:

As noted above, the SIP standard defines three different techniques for authentication, namely, the HTTP basic authentication method, the HTTP digest authentication method and the PGP authentication mechanism.

Therefore, a new authentication mode, a UMTS AKA mode, could be defined with the necessary fields. Alternatively,

the existing modes can be reused and adapted in order to perform the UMTS AKA procedure.

In order to be able to use the UMTS AKA procedure for authentication in IM subsystems, it is necessary to define how the UMTS AKA parameters are contained within the SIP messages. A new authentication method or mode may be introduced to include the UMTS AKA parameters in SIP messages. Noted below is a new authentication mode in accordance with the present invention. The new authentication mode contains headers which have been made as short as possible.

The WWW-Authenticate response header, in the case of a UMTS AKA procedure, must be able to carry both the RAND and AUTN. Accordingly, one example of a simple format which may be used is as follows:

```
WWW-Authenticate = "WWW-Authenticate" ":" "UMTS" RAND  
AUTN
```

```
RAND = "RAND" "=" RAND -value
```

```
AUTN = "AUTN" "=" AUTN -value
```

A hexadecimal format may be used for both the RAND and AUTN values.

The Authorization header, in the case of a UMTS AKA procedure, must be able to carry the RES value or the AUTS value. Accordingly, one example of a simple format which may be used is as follows:

```
Authorization = "Authorization" ":" "UMTS" RES | AUTS  
| AUTH-REJECT
```

```
RES = "RES" "=" RES-value
```

```
AUTS = "AUTS" "=" AUTS-value
```

```
5 AUTH-REJECT = "AUTH-REJECT" "=" error-code
```

A hexadecimal format may be used for both the RES and AUTS values.

The Proxy-Authenticate response header plays a role which is essentially the same as that of the WWW-Authenticate response header and therefore, one example of
10 a similar format which may be used is as follows:

```
Proxy-Authenticate = "Proxy-Authenticate" ":" "UMTS"  
RAND AUTN
```

```
RAND = "RAND" "=" RAND-value
```

```
15 AUTN = "AUTN" "=" AUTN-value
```

Similarly, the Proxy-Authorization response header plays a role which is essentially the same as that of the Authorization response header and therefore, one example of
a similar format which may be used is as follows:

```
20 Proxy-Authorization = "Proxy-Authorization" ":" "UMTS"  
RES | AUTS | AUTH-REJECT
```

```
RES = "RES" "=" RES-value
```

```
AUTS = "AUTS" "=" AUTS-value
```

```
AUTH-REJECT = " AUTH-REJECT" "=" error-code
```

Thus, in the case of an authentication mechanism in accordance with the present invention for use in an IM subsystem, UMTS AKA authentication may be used as a new authentication mode.

5 Since HTTP's basic and digest authentication mechanisms have been defined for use in the SIP draft standard, as noted below, the portions of the SIP message reserved for the digest mechanism may be alternatively used in accordance with a present invention to carry the UMTS AKA parameters:

10 For example, the "nonce" field formally used by the digest mechanism may be used to carry the UMTS AKA concatenated RAND and AUTN values in a hexadecimal format. Since the contents of the nonce field is implementation dependent, the length of the field must be large enough to carry the RAND and AUTN values. If this is not the case, the "opaque" field, defined in the draft standard, may be used to carry a portion of the UMTS AKA parameters.

15 The "response" field defined in the draft standard will be used for the UMTS AKA RES element. In case of a synchronization error, the AUTS will be included in the "response" field. The first character of the "response" field can indicate that the response includes the RES, the AUTS, or an error code. The RES and the AUTS may be in a hexadecimal format.

20

25

In authenticating with the SIP message portion formally used for the digest mode, an "algorithm" field which formally specified which algorithm to use to compute the digest (MD5 may be used by default), may, in accordance with the present invention, be used to inform the receiver that this is a UMTS AKA procedure and in this way, the receiver will understand that the nonce field actually carries the RAND and AUTN.

As noted above, the PGP mechanism has been defined for authentication use in the SIP draft standard. As alternative, this mode may be used in accordance with the present invention to carry the UMTS AKA parameters. That is:

The "nonce" field may carry the RAND and AUTN values.

The "PGP = algorithm" may inform the receiver that it is a UMTS AKA procedure.

The result will be included in the "PGP-signature". Since this field may be more than 200 bits long, some of the first bits of this field may be used to specify the type of result, e.g.-RES, AUTS, or error code.

This concludes the description of the example embodiments. Although the present invention has been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those

skilled in the art that will fall within the spirit and
scope of the principles of this invention. More
particularly, reasonable variations and modifications are
possible in the component parts and/or arrangements of the
5 subject combination arrangement within the scope of the
foregoing disclosure, the drawings, and the appended claims
without departing from the spirit of the invention. In
addition to variations and modifications in the component
parts and/or arrangements, alternative uses will also be
10 apparent to those skilled in the art.

What is claimed is:

CLAIMS:

1 **1.** A method of authenticating a user agent to a
2 server using SIP (Session Initiation Protocol) messages,
3 the method comprising:

4 forwarding an SIP request from the user agent to
5 the server;

6 forwarding a request for authentication from the
7 server to the user agent in response to the SIP request,
8 the request for authentication including information that
9 the authentication will be performed using a UMTS
10 (Universal Mobile Telecommunications System) AKA
11 (Authentication and Key Agreement) mechanism;

12 forwarding an authentication response from the
13 user agent to the server in response to the request for
14 authentication in accordance with the UMTS AKA mechanism;
15 and

16 performing an invoked SIP procedure on the server
17 in response to the SIP request if the authentication is
18 deemed successful in view of the authentication response.

1 **2.** The method of claim **1**, the SIP request comprising
2 one of an SIP INVITE request or an SIP REGISTER request.

1 **3.** The method of claim **1**, the request for
2 authentication comprising one of an SIP 401 Unauthorized
3 code or an SIP 407 Proxy Authentication Required code.

1 4. The method of claim 3, the request for
2 authentication comprising UMTS AKA RAND (RANDOM challenge)
3 and AUTN (authentication token) vectors.

1 5. The method of claim 4, the RAND and AUTN factors
2 being included in an SIP WWW-Authenticate or Proxy-
3 Authenticate response header field.

1 6. The method of claim 1, the authentication
2 response comprising one of a UMTS AKA RES (response) code
3 or an AUTS (synchronization failure parameter) code or an
4 error code.

1 7. The method of claim 6, the authentication
2 response being included in an SIP Authorization or Proxy-
3 Authorization header field.

1 8. The method of claim 1, the invoked procedure
2 comprising an acknowledgement response comprising an SIP
3 200 code.

1 9. A program storage device readable by a machine,
2 tangibly embodying a program of instructions executable by
3 the machine to perform a method of authenticating a user
4 agent to a server using SIP messages, the method
5 comprising:

6 forwarding an SIP request from the user agent to
7 the server;

8 forwarding a request for authentication from the
9 server to the user agent in response to the SIP request,
10 the request for authentication including information that
11 the authentication will be performed using a UMTS
12 (Universal Mobile Telecommunications System) AKA
13 (Authentication and Key Agreement) mechanism;

14 forwarding an authentication response from the
15 user agent to the server in response to the request for
16 authentication in accordance with the UMTS AKA mechanism;
17 and

18 performing an invoked SIP procedure on the server
19 in response to the SIP request if the authentication is
20 deemed successful in view of the authentication response.

21 **10.** The storage device of claim **9**, the SIP request
22 comprising one of an SIP INVITE request or an SIP REGISTER
23 request.

24 **11.** The storage device of claim **9**, the request for
25 authentication comprising one of an SIP 401 Unauthorized
26 code or an SIP 407 Proxy Authentication Required code.

27 **12.** The storage device of claim **11**, the request for
28 authentication comprising UMTS AKA RAND (RANDOM challenge)
29 and AUTN (authentication token) vectors.

1 **13.** The storage device of claim **12**, the RAND and
2 AUTN factors being included in an SIP WWW-Authenticate or
3 Proxy-Authenticate response header field.

1 **14.** The storage device of claim **9**, the authentication
2 response comprising one of a UMTS AKA RES (response) code
3 or an AUTS (synchronization failure parameter) code or an
4 error code.

1 **15.** The storage device of claim **14**, the
2 authentication response being included in an SIP
3 Authorization or Proxy-Authorization header field.

1 **16.** The storage device of claim **9**, the invoked
2 procedure comprising an acknowledgement response comprising
3 an SIP 200 code.

ABSTRACT OF THE DISCLOSURE

A technique for authenticating a user to a server using SIP messages includes forwarding an SIP request from the user agent to the server. The server then forwards a request for authentication to the user agent in response to the invite request, the request for authentication including information that the authentication will be performed using a UMTS AKA mechanism. The user agent then forwards and authentication response to the server in accordance with the UMTS AKA mechanism and the server then performs the appropriate actions to perform an invoked SIP procedure in response to the SIP request. The SIP request may include any standardized SIP request including an SIP INVITE request or an SIP REGISTER request. The request for authentication may include one of an SIP 401 Unauthorized code or an SIP 407 Proxy Authentication Required code. The request for authentication should include UMTS AKA RAND and AUTN vectors, which may be included in an SIP WWW-Authenticate or Proxy-Authenticate response header field. The authentication response should include one of either a UMTS AKA RES code or an AUTS code or an error code.

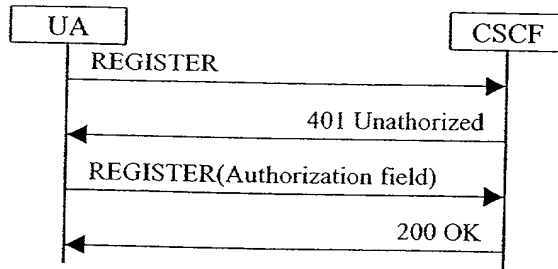


FIG. 1

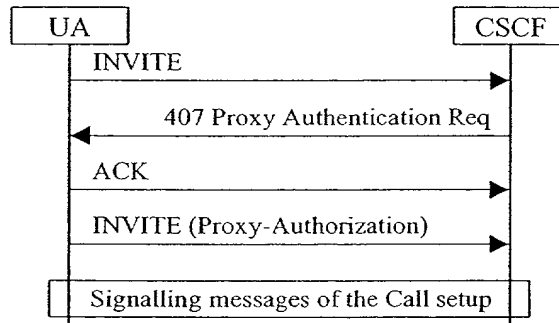


FIG. 2

DECLARATION AND POWER OF ATTORNEY - PATENT APPLICATION

As a below named inventor, I hereby declare: that my citizenship, residence and post office address are as stated below; that I verily believe I am the original, first and sole inventor (if only one is named below) or a joint inventor (if plural inventors are named below) of the invention entitled: **TECHNIQUES FOR PERFORMING UMTS (UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM) AUTHENTICATION USING SIP (SESSION INITIATION PROTOCOL) MESSAGES**, the specification of which

_____ is attached hereto
 x was filed on August 1, 2000, as Application
 Serial No. _____ and was amended on
 _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	_____ Yes	_____ No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application;

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status-patented, pending or abandoned.)
-----------------------------------	------------------------	--

I hereby appoint as principal attorneys: Donald R. Antonelli, Reg. No. 20,296; David T. Terry, Reg. No. 20,178; Melvin Kraus, Reg. No. 22,466; William I. Solomon, Reg. No. 28,565; Gregory E. Montone, Reg. No. 28,141; Ronald J. Shore, Reg. No. 28,577; Donald E. Stout, Reg. No. 26,422; Alan E. Schiavelli, Reg. No. 32,087; James N. Dresser, Reg. No. 22,973, Carl I. Brundidge, Reg. No. 29,621; and Paul J. Skwierawski, Reg. No. 32,173; to prosecute and transact all business in the Patent and Trademark Office connected with this application and any related United States and international applications.

Please Direct all Communications to:

Direct Telephone Calls To:

Antonelli, Terry, Stout & Kraus, LLP
1300 North 17th Street, Suite 1800
Arlington, VA 22209

(703) 312-6600

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

(Full Name)

(Signature)

Date _____ Inventor Stefano FACCIN
Residence Dallas, Texas Citizenship ITALY
Post Office Address 3421 Dartmoor, Dallas, TX 75229-2622

(Full Name)

(Signature)

Date _____ Inventor Franck LE
Residence Irving, Texas Citizenship FRANCE
Post Office Address 2715 West Royal Lane, No. 212, Irving, TX 75063

(Full Name)

(Signature)

Date _____ Inventor György WOLFNER
Residence Budapest, HUNGARY Citizenship HUNGARY
Post Office Address Szépvölgyi ut 4a, 1025 Budapest, HUNGARY